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GAW: 2772  
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I, KIM MARSHALL, MANAGER PATENT OPERATIONS hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PP 7718 for a patent by CANON KABUSHIKI KAISHA filed on 15 December 1998.

WITNESS my hand this  
Second day of December 1999

KIM MARSHALL  
MANAGER PATENT OPERATIONS



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**ORIGINAL**

**AUSTRALIA**

**Patents Act 1990**

**PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:**

Auto Kerning

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Name and Address  
of Applicant:

Canon Kabushiki Kaisha, incorporated in Japan, of 30-2,  
Shimomaruko 3-chome, Ohta-ku, Tokyo, 146, JAPAN

Name of Inventors: Cameron Bolitho Brown and Paul Quentin Scott.

This invention is best described in the following statement:

## AUTO KERNING

The present invention relates to kerning which is the adjusting of the spaces between adjacent characters in a character string so as to create a more aesthetically  
5 pleasing appearance than would be the case if the spacing were entirely regular. In particular, the present invention relates to a method of adjusting kerning for modified characters where a kerning value for each pair of unmodified characters is already known.

### 10 Background Art

It is well known that kerning is required in order to produce an aesthetically pleasing result from a string of characters. This kerning is the movement of the characters in the character string direction, or the kerning direction (i.e. along the line along which the characters are to appear), so as to adjust the spacing between adjacent  
15 characters. For many character fonts a kerning table is provided in which for each pair of adjacent characters a kerning value is to some extent empirically provided and which enables the printer or other display device to adjust the spacing between the characters in the kerning direction accordingly.

In recent times computer technology has enabled a bewildering variety of  
20 modifications to existing characters to be created, for example, by some form of perturbation applied to the character outline. As a result of this perturbation the characters change their appearance. Therefore a modified form of kerning is required in order to display the modified characters at their best.

It is the object of the present invention to provide such a form of kerning in  
25 such a way that it can be easily accommodated by the printer or other display device.

## Summary of the Invention

In accordance with a first aspect of the present invention there is disclosed a method of adjusting kerning for modified characters where a kerning value for each unmodified character pair is known, said method comprising the steps of:

- 5           1.       estimating an amplitude of the character modification in the kerning direction for each character of the pair, and
2.       increasing the kerning value for each character pair by substantially the sum of said amplitudes.

In accordance with a second aspect of the present invention there is disclosed  
10   apparatus for adjusting the kerning values for modified character pairs based on a known kerning value for each unmodified character pair, said apparatus comprising first memory means to store said known kerning value for each unmodified character pair, value adjusting means to add to each said known kerning value substantially the sum of the estimated amplitudes of the character modification for each character of the  
15   pair in the kerning direction, and second memory means to store the sum of said addition as an increased kerning value for each modified character pair.

## Brief Description of the Drawings

A preferred embodiment of the present invention will now be described with  
20   reference to the drawings in which:

Fig. 1 is a view of two unmodified characters showing the kerning value for such characters,

Fig. 2 is a view similar to Fig. 1 but showing the arrangement for modified characters, and

25   Fig. 3 is a schematic circuit diagram of one embodiment of hardware by means of which the preferred embodiment of the present invention can be implemented.

Fig. 4 is a view of two characters modified by a large amplitude, low frequency perturbation.

## Detailed Description

As seen in Fig. 1, a pair of characters H, K are shown arranged "along the line" upon which a string of characters is to be written. Each character is located within its own bounding box 2 indicated by dotted lines. As is well known, in the process of kerning, the distance between the adjacent bounding boxes is adjusted in order to achieve an aesthetically pleasing result. Since the number of characters in a font is fixed, the kerning values are conveniently stored in memory with the appropriate value for each possible character pair being thus stored.

In this way, as each successive character is placed in the string of characters, the appropriate kerning value is looked up and the necessary adjustment between the adjacent bounding boxes made. This is a quick and easy procedure which enables high speed printing or other display to be carried out.

Fig. 2 illustrates a modified pair of characters which are modified by the application of a substantially sinusoidal wave to the character outline. The effect of the modification is to move the edge of the character inwards, and outwards, by a predetermined amplitude "a" from its unperturbed position. In Fig. 2 the amplitude "a" of the sine wave is indicated and it will be apparent to those skilled in the art that since the characters are thus modified, there will need to be some modification of the kerning value for the modified character pair.

In Fig. 1 the kerning value for the unmodified character pair is given by  $k_1$  whilst in Fig. 2 the kerning value for the modified character pair is given as  $k_2$ . In accordance with the preferred embodiment of the present invention, since the outline of the right-hand side of the character H has been moved to the right by a distance a, and the outline of the left-hand side of the character K has been moved to the left by a distance equal to the amplitude a, the new kerning value  $k_2$  should be increased over the original kerning value  $k_1$  by twice the amplitude a. That is, expressed mathematically:

$$k_2 = k_1 + 2a \quad [1]$$



Fig. 3 schematically illustrates a circuit for carrying out the required modification in accordance with equation [1]. A read only memory 5 is used to store the kerning values for each pair of unmodified characters and is connected to one input of an adder 6. The other input of the adder 6 is connected to a register 7 loaded with a constant value which is twice the amplitude  $a$ . The output of the adder 6 is stored in a second memory in the form of RAM 8.

Figure 4 illustrates a pair of characters which are modified by application of a substantially sinusoidal wave to the character outline. The sinusoidal perturbation has a low frequency, and consequently has a wavelength which is substantially of the same order as the size of the characters. This results in the character outlines being adjusted outward (i.e. in a convex fashion) in some instances, and inward (i.e. in a concave fashion) in other cases. In Fig. 4, in accordance with the preferred embodiment of the present invention, the outline of the top right-hand side of character H has been moved to the left by a distance  $b_1$  and the outline of the top left-hand side of character K has been moved to the left by a distance  $c_1$ . Thus the new kerning value  $k_2$  should be decreased over the original kerning value  $k_1$  by  $c_1$ , and should be increased over the original kerning value  $k_1$  by  $b_1$ . That is, expressed mathematically:

$$k_2 = k_1 - c_1 + b_1 \quad [2]$$

20

Alternatively, different aspects of the perturbed characters may be considered. Thus, since the outline of the right-hand centre of character H has been moved to the left by a distance  $b_2$  and the outline of the left-hand centre of character K has been moved to the left by a distance  $c_2$ , the new kerning value  $k_2$  should be decreased over the original kerning value  $k_1$  by  $c_2$ , and increased by  $b_2$ . That is, expressed mathematically:

25

$$k_2 = k_1 - c_2 + b_2 \quad [3]$$

A general kerning adjustment equation may, therefore, be tailored to correctly kern text undergoing specific distortions. The general equation is expressed mathematically as follows:

5 
$$k_2 = k_1 + f(a) + g(b) \quad [4]$$

where a is the amplitude of the perturbation applied to the left-hand character H, and b is the amplitude of the perturbation applied to the right-hand character K. Furthermore, f is an arbitrary function or operator which is applied to amplitude a, and  
10 g is an arbitrary function or operator which is applied to amplitude b.

Fig. 5 schematically illustrates a generalization of the circuit depicted in Fig. 3, the generalisation being in accordance with equation [4]. Register 7 (see Fig. 3) is replaced by two registers 8 and 9, whose contents (g(b) and f(a) respectively) are summed by adder 10.

15 In printing or otherwise displaying the modified characters, the printer or other display device takes the kerning value for each pair of values from RAM 8 instead of from ROM 5 and in this way adjusts the kerning for the modification made to the characters.

The forgoing describes only one embodiment and modifications obvious to  
20 those skilled in the art, can be made thereto without departing from the scope of the present invention. For example, although a sinusoidal modification of the characters has been illustrated in Fig. 2, the modification could equally have been in the form of a square wave or a triangular wave or some other blurring or other distortion of the initial character outline.

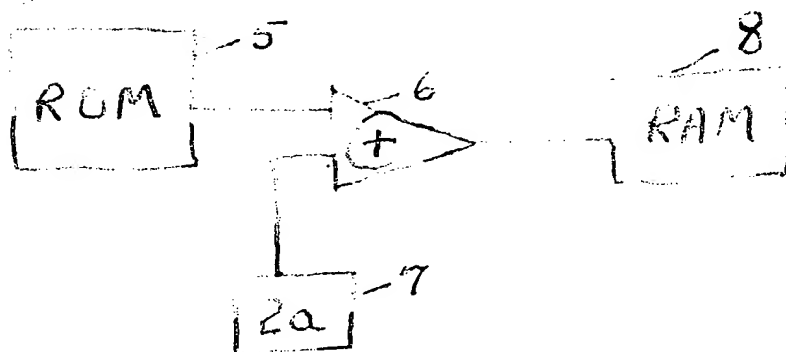
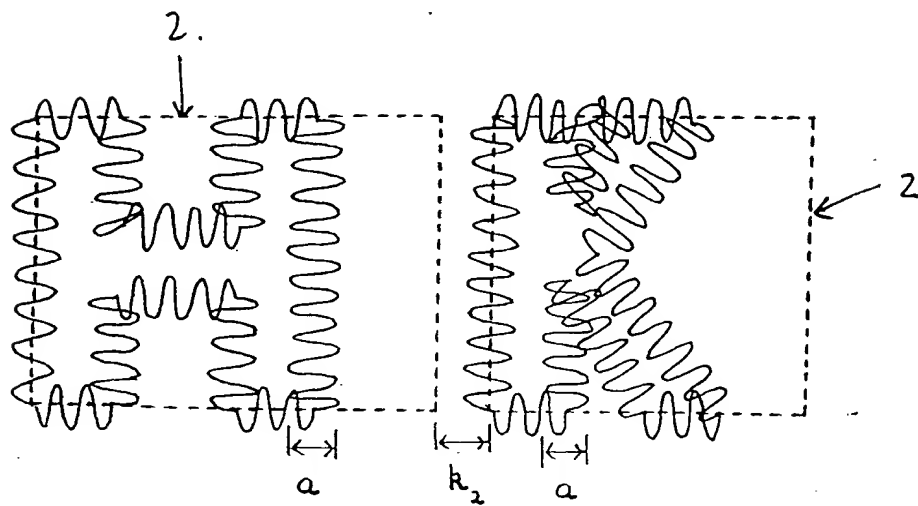
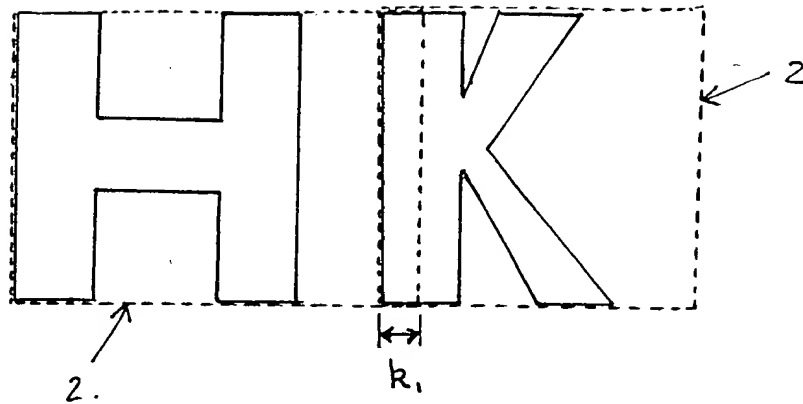
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## Aspects of the Invention

The following paragraphs describe various aspects of the invention:

1. A method of adjusting kerning for modified characters where a kerning value for each unmodified character pair is known, said method comprising the  
5 steps of:
  - a. estimating an amplitude of the character modification in the kerning direction for each character of the pair,
  - b. applying a function to each amplitude, and
  - c. increasing the kerning value for each character pair by substantially  
10 the sum of said functions.
2. A method as described in paragraph 1 wherein the modification to each character comprises perturbing the outline of the character.
3. A method as described in paragraph 2 wherein the perturbation is selected from the group consisting of sinusoidal, square wave, and triangular wave  
15 perturbations.
4. Apparatus for adjusting the kerning values for modified character pairs based on a known kerning value for each unmodified character pair, said apparatus comprising first memory means to store said known kerning value for each unmodified character pair, value adjusting means to add to each said known kerning value  
20 substantially the sum of functions which are applied to the estimated amplitudes of the character modification for each character of the pair in the kerning direction, and second memory means to store the sum of said addition as an increased kerning value for each modified character pair.
5. Apparatus as described in paragraph 4 wherein said first memory means  
25 is a ROM.
6. Apparatus as described in paragraph 4 or 5 wherein said second memory means is a RAM.
7. Apparatus as described in any of paragraphs 4-6 wherein said value adjusting means is an adder.

**Dated this FIFTEENTH day of DECEMBER 1998**  
**Canon Kabushiki Kaisha**  
**Patent Attorneys for the Applicant**  
**SPRUSON & FERGUSON**



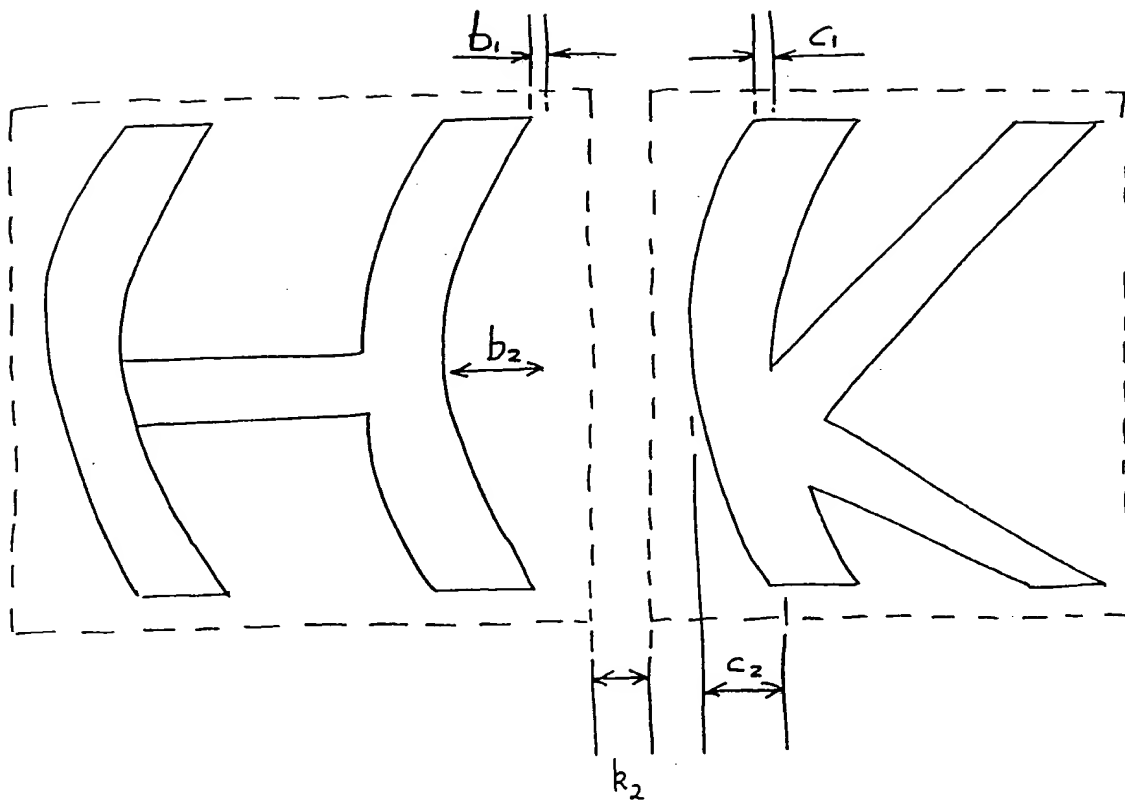


FIG 4

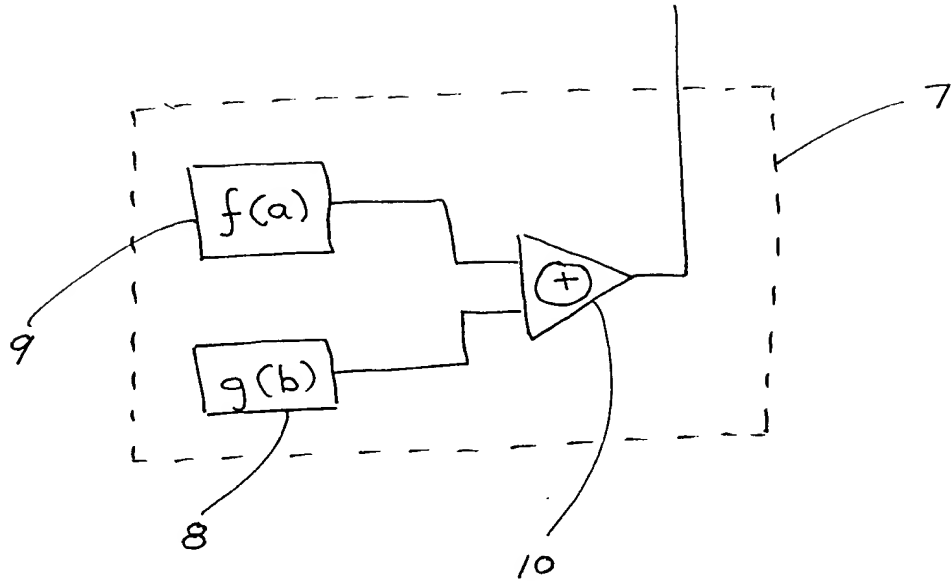


FIG 5

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